Hydraulic and Breach Analysis of a Dam in North Texas
Project Update

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for:
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This project focuses on a dam in north Texas. The goals of the project are to determine if the dam can safely pass the probable maximum flood (PMF) and to determine the area of inundation downstream of the dam if the dam were to breach on a sunny day or during a PMF event.

For the first goal of this project, ArcGIS was used along with Geo-HMS to determine the drainage area upstream of the dam. This process included obtaining the national elevation dataset, filling sinks, determining the flow direction and flow accumulation, as well as delineating the catchments and drainage lines. The individual catchments that were defined by the software were combined into two main basins. The drainage areas, stream slopes and the longest flow paths for each basin have been. This data was used to determine the time of concentration and lag time for each basin. Figure 1 (page 3) shows the basins, longest flowpath, and stream network upstream of the dam. The data from ArcGIS was exported for use in HEC-HMS.

Additionally, two methods are being employed to determine the curve number (CN) of the soils in each basin. The first method was to obtain soil data from the NRCS Web Soil Survey for a manual calculation of the CN. The data was added to the map and can be seen in Figure 2 (page 3). The calculate geometry function in ArcGIS was used to determine the acreage of each soil type and the attribute table was exported to Excel for CN calculations. The second method to determine the CN is to use a beta-testing version of a curve number calculator tool by ESRI. The tool uses the National Land Cover Database available through the ArcGIS servers.

In order to determine if the dam can safely pass the PMF, the probable maximum precipitation (PMP) from Hydrometeorological Report No. 51 was determined for Montague County for 6-hour, 12-hour, 24-hour, 48-hour, and 72-hour events. The data was plotted and used to extrapolate the 1, 2, and 3-hour PMPs. The plot is included as Figure 3 (page 3). The PMP data will be entered into HEC-HMS for use in the model.

The difficulties that have come up so far have been minor. The first difficultly was in obtaining the 10 meter national elevation data (NED) and soil survey data from the government websites that were down at the beginning of October. In the meantime, the 30 meter NED data was used from the ArcGIS servers. Another difficulty that has surfaced came up after downloading and processing the 10 meter NED data. The stream networks that were produced with the 30 meter and 10 meter data were noticeably different. The difficulty was how to determine which one was "correct." Obviously, the 10 meter data is a better resolution dataset. However, the stream network that was found for the 30 meter data was more consistent with the location of the dam. Therefore, the 30 meter NED was used throughout this project.

While determining which dataset to use, it became clear that this dam is going to be difficult to model. There is actually an old, upper dam that drains the upper basin into the lower basin which exits out the actual dam that is the focus of this project. There was some difficulty determining the best way to approach this for the HMS model. Once the NED decision was settled, it became clearer how to model the project. The HMS model will include a dam at each of the basin outlets; however, the hydrology and hydraulics will only be studied for the lower dam.

The next steps that need to be taken to complete the first goal of this project are to complete the curve number calculations and to finish the HEC-HMS modeling. This will include entering the PMP values, dimensions of the dam spillway and dam top, and the elevation-storage data into the HEC-HMS model. The model will be run for each of the PMPs described above (1-hour through 72-hours) to determine if the dam will be overtopped during any of those events. This should be accomplished easily as all of the necessary data has been obtained.

The final part of the project is to determine the inundation area during a dam breach. This will include using Geo-RAS and HEC-RAS. I have scheduled a meeting with Denny Rivas to discuss this undertaking. In addition, I have some training materials for breach analyses using the RAS software available from work. This portion of the project will take some work since I am unfamiliar with the RAS software packages.

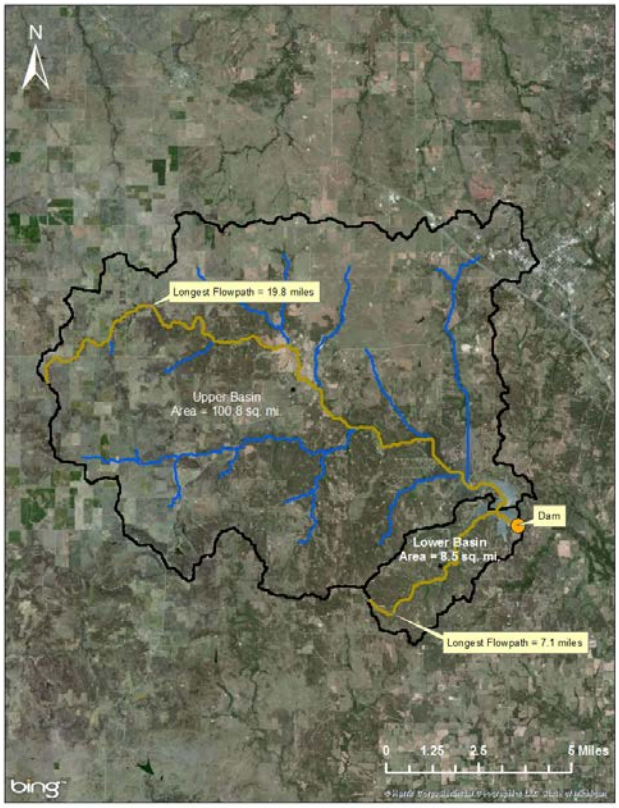

Figure 1 – Basin Characteristics

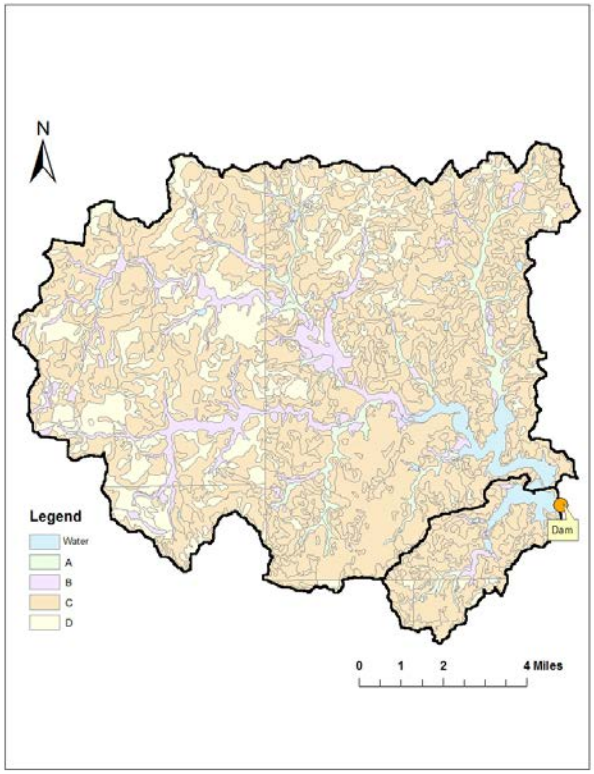

Figure 2 – Soil Types

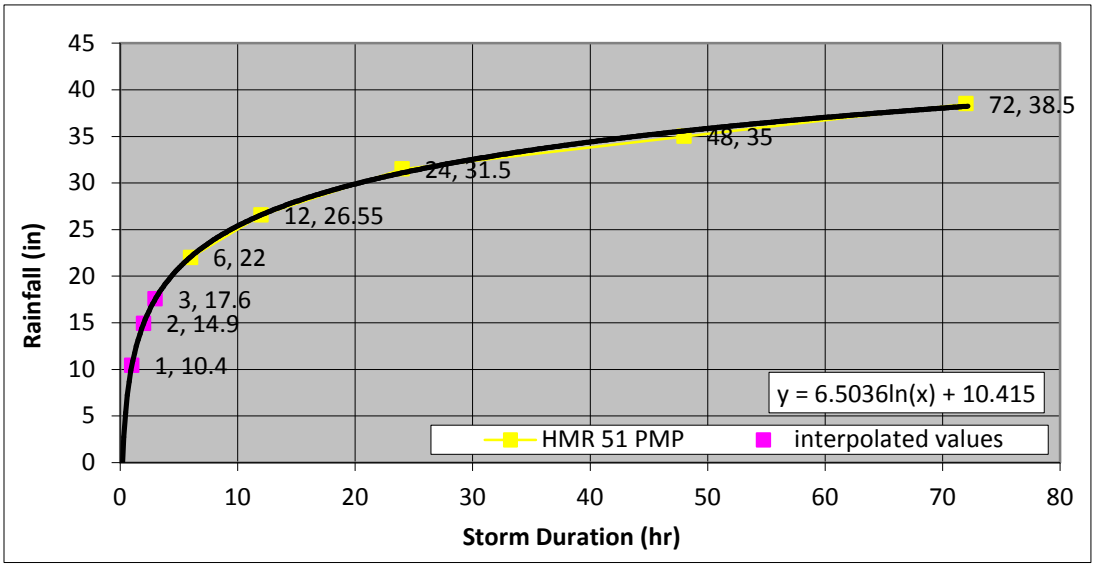

Figure 3 – PMP for Montague County